

SCIENCE & EDUCATION Impact

Benefits from USDA/Land-Grant Partnership

High Tech Agriculture

The future of farming.

Few new technologies have raised hopes as high as biotechnology has. Its futuristic appeal has grabbed newspaper headlines around the world. According to some experts, biotechnology could double or triple yields per acre and yield new and varied products from the same crops. Today's new biotechnology tools are based on the biochemistry of cells and their DNA. With the help of the U.S. Department of Agriculture (USDA) and Land-Grant universities, these tools are being used to develop, among other things, crops with novel characteristics, new vaccines and new industrial uses of agricultural products.

Payoff

- **Healthy heifers.** Mastitis is an important dairy cattle disease that reduces milk production by an estimated \$1 billion annually. A vaccine developed at **University of California-Davis** prevents bacterial mastitis infections in dairy cattle. It has saved the California dairy industry \$11 million a year—about \$52 per cow, or roughly 25% of a producer's profit margin. In **Vermont**, scientists have developed a gene that provides animals with anti-bacterial proteins that protect against mastitis infection. And **Massachusetts** has begun developing oral supplements to help cows ward off mastitis infections.
- **Protein probes.** Recombinant proteins are used to develop vaccines and medical diagnostic tests for infectious diseases. Scientists need a safer and easier way to produce high-quality, recombinant proteins in the laboratory with minimal costs. Researchers at **Texas A&M** are testing the rapid production technology for identifying recombinant proteins. At last count more than 50 institutes worldwide are using the technology, with some 750 proteins identified.
- **Macho bass.** Aquaculture is one of the fastest growing industries in the United States. However, the breeding of striped bass still depends primarily on the development of brood stocks and seed from wild populations. **Maryland** investigators are developing ways to freeze striped bass sperm. In hatcheries, freezing sperm can supplement the breeding process, limiting the number of males required, decreasing storage space and maintenance and thus lowering costs. Researchers at **Auburn University** are also working on the biochemistry and physiology of striped bass sperm to make hatcheries more efficient.

RESEARCH,
EXTENSION AND
EDUCATION
AT WORK

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- **Hindering herpes.** Two viruses, bovine herpes virus and human herpes simplex virus, are especially difficult to control because they cause latent (once infected, symptoms can occur periodically thereafter) infections. **Nebraska** veterinary scientists studying the genetics of latency in herpes viruses discovered a gene that appears to control latency and are the first researchers to demonstrate that the protein this gene produces inhibits cell death of infected tissue. If researchers can discover how to switch off the latency-related gene and prevent a virus from becoming latent, they could make better vaccines and slow or inhibit virus transmission.
- **Bacteria anyone?** **Montana State** researchers have developed a unique method of protecting cattle and wildlife from brucellosis-bacteria. Delivering the genetically modified organisms by spraying hay or other forage is considerably cheaper than traditional methods. The **Louisiana State** brucellosis research team is taking another approach by attempting to genetically improve existing vaccines. With about half of bison populations infected with brucellosis, developing a novel delivery system that would vaccinate both bison and cattle against infection is prudent.
- **Computer aids.** Swine production is in jeopardy from the swine virus disease Porcine Reproductive and Respiratory Syndrome (PRRS). **Minnesota** researchers are using a computer simulation model originally developed for pseudorabies (PRV) virus. With the help of the model, the virus can be eliminated through more effective management. **South Dakota** scientists have developed the first computerized, instrumentation-based system to measure thousands of sperm cells in a sample in just seconds. The system allows faster fertility assessment and detection of environmental heat stress and loss of sperm quality. The faster evaluation will help artificial insemination companies and improve their screening rates.
- **Chicken cough.** About 1.5 percent of the poultry processed in Mississippi is condemned at the processing plants. Of this, 15 percent is due to infectious bronchitis. Researchers at **Mississippi State** have shortened the time needed to run biochemical tests that detect infectious bronchitis. Instead of taking six to seven days, the test now takes three. Based on 1998

production figures, allowing ample time for vaccination prior to slaughter will result in an estimated savings of \$1.7 million annually.

- **Just say no.** Understanding how cells reject drugs by moving molecules from one side of a cell membrane to another is the challenge researchers at **Delaware** and **Purdue** are tackling. By understanding how the process works, pharmaceutical companies can create new anticancer drugs. Similarly, more effective antibiotics can be developed if the rejection systems in pathogenic bacteria and other organisms can be overcome.
- **Good fat, bad fat.** Risk assessment is an important step in heart-disease management. **North Carolina State** scientists use nuclear magnetic resonance technology to allow direct and simultaneous measurement lipoprotein particles that contribute to heart diseases. The measurement process is rapid and efficient, making it cost-effective and clinically accessible.



**Cooperative State Research, Education,
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